

CLAIMS:

1. An organic optoelectronic device structure comprising:

a first barrier region comprising a substrate layer and a plurality of cooperative barrier layers disposed on said substrate layer, said plurality of cooperative barrier layers further comprising one or more planarizing layers and one or more high-density layers, wherein at least one high-density layer is disposed over at least one planarizing layer in a manner such that said at least one high-density layer extends to said substrate layer and cooperates with said substrate layer to completely surround said at least one planarizing layer;

an organic optoelectronic device disposed over said first barrier region, said organic optoelectronic device selected from an organic light emitting diode, an organic electrochromic display, an organic photovoltaic device and an organic thin film transistor; and

a second barrier region disposed over said organic optoelectronic device.

2. The organic optoelectronic device structure of claim 1, wherein each overlying cooperative barrier layer that is disposed on one or more underlying cooperative barrier layers extends to the substrate layer in a manner such that said one or more underlying cooperative barrier layers are surrounded by said substrate and each said overlying cooperative barrier layer.

3. The organic optoelectronic device structure of claim 1, wherein said cooperative barrier layers comprise an alternating series of two or more planarizing layers and two or more high-density layers.

4. The organic optoelectronic device structure of claim 1, wherein said second barrier region comprises a metal layer.
5. The organic optoelectronic device structure of claim 1, wherein said substrate layer is a polymer substrate layer.
6. The organic optoelectronic device structure of claim 5, wherein said polymer substrate layer comprises one or more polymer components selected from a polyester, a polyolefin, a polycarbonate, a polyether, a polyimide and a polyfluorocarbon.
7. The organic optoelectronic device structure of claim 1, wherein said one or more planarizing layers comprise a material selected from fluorinated polymers, parylenes, cyclotenes and polyacrylates.
8. The organic optoelectronic device structure of claim 1, wherein said one or more high-density layers comprise a material selected from metal oxides, metal nitrides, metal carbides, metals and metal oxynitrides.
9. An OLED structure comprising:
  - a first barrier region comprising a substrate layer and a plurality of first cooperative barrier layers disposed on said substrate layer, said plurality of first cooperative barrier layers further comprising one or more first planarizing layers and one or more first high-density layers, wherein at least one first high-density layer is disposed over at least one first planarizing layer in a manner such that said at least one first high-density layer extends to said substrate layer and cooperates with said substrate layer to completely surround said at least one first planarizing layer;
  - an OLED disposed over said first barrier region, said OLED comprising an anode, a cathode and an organic emissive layer; and

a second barrier region disposed over said OLED.

10. The OLED structure of claim 9, wherein each overlying first cooperative barrier layer that is disposed over one or more underlying first cooperative barrier layers extends to the substrate layer in a manner such that said one or more underlying first cooperative barrier layers are surrounded by said substrate layer and said overlying first cooperative barrier layer.

11. The OLED structure of claim 9, wherein said first cooperative barrier layers comprise an alternating series of two or more first planarizing layers and two or more first high-density layers.

12. The OLED structure of claim 11, wherein said alternating series comprises 3 to 7 first planarizing layers and 3 to 7 first high-density layers.

13. The OLED structure of claim 9, wherein said one or more first planarizing layers comprise a material selected from fluorinated polymers, parylenes, cyclotenes and polyacrylates.

14. The OLED structure of claim 9, wherein said one or more first high-density layers comprise a material selected from metal oxides, metal nitrides, metal carbides, metals and metal oxynitrides.

15. The OLED structure of claim 9, wherein said one or more first high-density layers comprises a material selected from silicon oxide, silicon nitride, aluminum oxide, indium tin oxide and zinc indium tin oxide.

16. The OLED structure of claim 9, wherein said substrate layer is a polymer substrate layer.
17. The OLED structure of claim 17, wherein said polymer substrate layer comprises one or more polymer components selected from a polyester, a polyolefin, a polycarbonate, a polyether, a polyimide and a polyfluorocarbon.
18. The OLED structure of claim 17, wherein said polymer substrate layer comprises one or more polymer components selected from a polyethersulphone, a polyarylate, a polyestercarbonate, a polyethylenenaphthalate, a polyethyleneterephthalate, a polyetherimide, a polyacrylate, and a polynorbornene.
19. The OLED structure of claim 18, wherein said polymer substrate layer is a polyethyleneterephthalate layer.
20. The OLED structure of claim 17, wherein said polymer substrate layer ranges from 75 to 625 microns in thickness.
21. The OLED structure of claim 9, wherein said second barrier region comprises a metal layer.
22. The OLED structure of claim 9, wherein said first barrier region is bonded to said second barrier region by an adhesive region.
23. The OLED structure of claim 22, wherein said adhesive region comprises an epoxy material.

24. The OLED structure of claim 9, wherein said second barrier region comprises a plurality of second cooperative barrier layers, said plurality of second cooperative barrier layers further comprising one or more second planarizing layers and one or more second high-density layers, and wherein at least one second high-density layer is disposed over at least one second planarizing layer in a manner such that said at least one second high-density layer extends to said first barrier region and cooperates with said first barrier region to completely surround said at least one second planarizing layer.

25. The OLED structure of claim 24, wherein each overlying second cooperative barrier layer that is disposed over one or more underlying second cooperative barrier layers extends to the first barrier region in a manner such that said one or more underlying second cooperative barrier layers are surrounded by said first barrier region and said overlying second cooperative barrier layer.

26. The OLED structure of claim 24, wherein said second cooperative barrier layers comprise an alternating series of two or more second planarizing layers and two or more second high-density layers.

27. The OLED structure of claim 26, wherein said alternating series comprises 3 to 7 second planarizing layers and 3 to 7 second high-density layers.

28. The OLED structure of claim 24, wherein said one or more second planarizing layers comprise a material selected from fluorinated polymers, parylenes, cyclotenes and polyacrylates.

29. The OLED structure of claim 24, wherein said one or more second high-density layers comprise a material selected from metal oxides, metal nitrides, metal carbides, metals and metal oxynitrides.

30. The OLED structure of claim 24, wherein said one or more second high-density layers comprises a material selected from silicon oxide, silicon nitride, aluminum oxide, indium tin oxide and zinc indium tin oxide.

31. The OLED structure of claim 9, further comprising a gettering material disposed between said first and second barrier regions.

32. The OLED structure of claim 9, further comprising a third barrier region disposed between said first barrier region and said OLED, said third barrier region comprising a plurality of third cooperative barrier layers, said plurality of third cooperative barrier layers further comprising one or more third planarizing layers and one or more third high-density layers, wherein at least one third high-density layer is disposed over at least one third planarizing layer in a manner such that said at least one third high-density layer extends to said first barrier region and cooperates with said first barrier region to completely surround said at least one third planarizing layer.

33. A covered substrate comprising:

a flexible substrate layer; and

a plurality of cooperative barrier layers disposed on said substrate layer, said plurality of cooperative barrier layers further comprising one or more planarizing layers and one or more high-density layers, wherein at least one high-density layer is disposed over at least one planarizing layer in a manner such that said at least one high-density layer extends to said substrate layer and cooperates with said substrate layer to completely surround said at least one planarizing layer.

34. The covered substrate of claim 33, wherein each overlying cooperative barrier layer that is disposed over one or more underlying cooperative barrier layers extends to the

substrate layer in a manner such that said one or more underlying cooperative barrier layers are surrounded by said substrate layer and said overlying cooperative barrier layer.

35. The covered substrate of claim 33, wherein said cooperative barrier layers comprise an alternating series of two or more planarizing layers and two or more high-density layers.

36. The covered substrate of claim 35, wherein said alternating series comprises 3 to 7 planarizing layers and 3 to 7 high-density layers.

37. The covered substrate of claim 33, wherein said one or more planarizing layers comprise a material selected from fluorinated polymers, parylenes, cyclotenes and polyacrylates.

38. The covered substrate of claim 33, wherein said one or more high-density layers comprise a material selected from metal oxides, metal nitrides, metal carbides, metals and metal oxynitrides.

39. The covered substrate of claim 33, wherein said one or more high-density layers comprises a material selected from silicon oxide, silicon nitride, aluminum oxide, indium tin oxide and zinc indium tin oxide.

40. The covered substrate of claim 33, wherein said substrate layer is a polymer substrate layer.

41. The covered substrate of claim 40, wherein said polymer substrate layer comprises one or more polymer components selected from a polyester, a polyolefin, a polycarbonate, a polyether, a polyimide and a polyfluorocarbon.

42. The covered substrate of claim 40, wherein said polymer substrate layer comprises one or more polymer components selected from a polyethersulphone, a polyarylate, a polyestercarbonate, a polyethylenenaphthalate, a polyethyleneterephthalate, a polyetherimide, a polyacrylate, and a polynorbornene.

43. The covered substrate of claim 40, wherein said polymer substrate layer ranges from 75 to 625 microns in thickness.